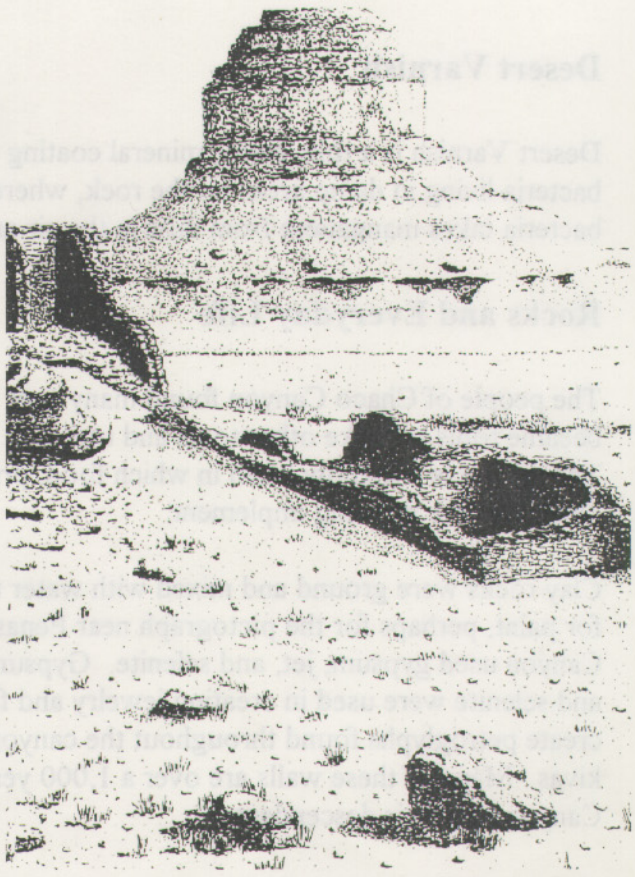
GEOLOGY OF CHACO CANYON



The stark landscape of Chaco Canyon is hanutingly beautiful. Sunlight and shadows play on towering rock walls where petroglyphs keep secret the history of an ancient people. The canyon floor is still lumped with the buried remains of Pueblo dwellings. Those which have been excavated are as mysterious as they are revealing. Visitors come from all over the world to this spectacular place to enjoy the natural beauty and to marvel at the grandeur of the ancient sandstone buildings that remain.

Canyon Formation

Chaco Canyon lies in the middle of the San Juan Basin near the southeastern part of the Colorado Plateau geological region. This region has broad exposures of horizontal sedimentary layers that have eroded into plateaus, mesas, buttes, and canyons. Chaco is typical of this scenic country.

Exposed rocks in the canyon record a short interval of earth history in the Late Cretaceous Period, about 80 million years ago. At that time Chaco was part of the shifting coastline of an ancient sea. Called by geologists an epicontinental sea, its movement back and forth across the Four Corners area helped deposit the layers of rock known as the Colorado Plateau. Fossils from the 80 million year old sea can be found in the canyon but fossilized casts of the sea creatures that flourished here are more visible. While walking along the trails, casts of shells, crustacean burrows, and shark's teeth can be seen.

The Menefee Formation is the oldest exposed sedimentary layer and consists of shale and coal deposits interspersed with sandstone. The Menefee is visible in the slopes underlying the mesas that are capped by Cliff House sandstone. In some parts of the canyon, beds of Menefee and Cliff House sandstone are sandwiched together, representing the advance and retreat of the sea. Lewis shale is another sediment overlying some areas of the Cliff House sandstone and it too is largely covered by loose shallow deposits.

The sandstone cliffs are more resistant to erosion than the softer underlying Menefee Formation. The Menefee can erode completely out from beneath the Cliff House sandstone, causing the sandstone to break down and pile up in what is called a talus slope. As a result of this erosion, boulders and large slabs of sandstone will slide or fall onto the slope and can extend halfway up the cliff. Fajada Butte, south of the Visitors Center and once part of Chacra Mesa, is the result of erosion in recent geologic time. Formed within the last 10,000 years, the butte is an example of Menefee Formation capped by Cliff House sandstone.

Desert Varnish

Desert Varnish is a thin, shiny, mineral coating that appears in dark streaks on the canyon wall. It is believed that bacteria living in damp areas on the rock, where rainfall runs over the edge, causes this phenomenon. The bacteria takes manganese from dust in the air and metabolizes it so that it becomes fixed to the canyon wall.

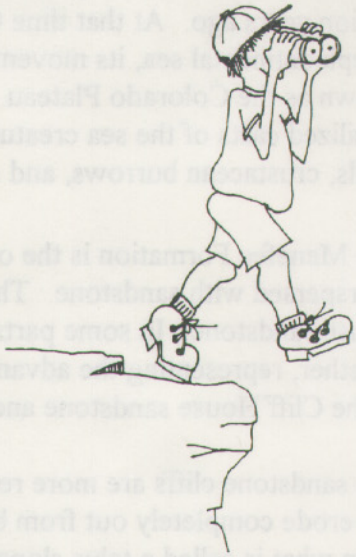
Rocks and Everyday Life

The people of Chaco Canyon found many uses for the rocks in their environment. Small rocks with sharp edges became tools to make other tools and utensils. Another example is the metate and mano, both made of stone. The metate is a shallow basin in which food, primarily corn, was ground. The mano, a stone rounded to fit the hand, was the grinding implement.

Clay rocks were ground and mixed with water to make pottery. Ocher from the sandstone cliffs was a pigment for paint, perhaps for the pictograph near Penasco Blanco. From the Menefee Formation, the natives of Chaco Canyon used gypsum, jet, and selenite. Gypsum was used to lighten the plaster that coated their walls, and jet and selenite were used in creating jewelry and for carving small figurines. Harder rocks were used to peck and create petroglyphs found throughout the canyon. Most impressive of all is the sandstone of the pueblos and kivas. Many of these walls are over a 1,000 years old and are a fragile, silent testimony to the people of Chaco Canyon and their descendants.

Some Geologic Hazards

Soil and rock are always on the move through weathering, erosion, gravity, and the broad upward movement of the earth's crust due to stresses known as tectonic uplift. The landscape is reshaped over hundreds, perhaps thousands, of years by these forces. Rapid occurrences, like rockfalls and earthquakes, also do their share of redistributing soil and rock.



Rock cliffs are subject to vertical cracks from the alternation of freezing and thawing. When a section becomes separated from the cliff wall, erosion at its base can cause collapse. When the ancient builders were constructing Pueblo Bonito, a gigantic sandstone slab rested in a precarious position just behind it. Aware of the threat that it posed, the Chacoans built an earth and masonry retaining wall beneath this massive rock slab. When the slab was first described in 1901, it was referred to as the "Elephant", the Navajos called it "Braced-up Cliff", and the Park Service named it "Threatening Rock". In an attempt to predict the fall of "Threatening Rock", the Park Service took on the job of monitoring its movement. However, there was very little that could be done to prevent its fall and on January 22, 1941, "Threatening Rock" collapsed taking several rooms of Pueblo Bonito with it.